

# A New Clinical Observation Utilizing a Traditional Tendon Transfer to Improve Hand Function in Sunderland III Radial Nerve Injuries

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## PURPOSE

To highlight a subtle clinical exam finding in patients with a Sunderland grade III component to radial nerve injuries, where recovered digital extensors attempt to aid weak wrist extensors, ultimately leading to dysfunctional grasp. To demonstrate improved functional grasp following a tendon transfer to restore grip kinematics by augmenting isolated wrist extension strength.

## BACKGROUND

- Meaningful grip requires the wrist to be in a position of extension. Without this, the finger flexors are at a significant biomechanical disadvantage, which is exaggerated with attempted grasp owing to the moment arm of the digital flexors.
- More complex, mixed nerve injuries can lead to patterns of recovery that are less well understood. For the radial nerve, this may lead to elbow, wrist, and digital extension to recover with varying amounts of functional strength.
- When upper extremity muscle strength is reduced, compensatory substitutions will often occur. Early recognition of maladaptive substitutions is vital to improving patient outcomes.
- We present two patient who recovered greater digital extensor than wrist extensor muscle strength, resulting in a biomechanically disadvantageous substitution.

## PHYSICAL EXAM FINDINGS

Both patients had a flexed wrist posture at rest and would assume a “hook fist” posture when asked to extend the wrist or make a fist (see fig. 1). Manual muscle testing revealed at least 4-/5 strength in EDC and 2/5 or less in the wrist extensors (ECRL/ECRB). Digit to palmar crease distance was > 1 cm for all digits in this posture. Passively supporting the wrist in a functional degree of extension allowed EDC relaxation improved grip and DPC.

## FIGURE 1



(Top) Hook fist posture assumed by patients where PIN innervated muscles recover more fully and earlier than the radial wrist extensors. This posture is secondary to maladaptive compensatory pull through the EDC across the MP joints in an attempt to obtain the appropriate wrist extension necessary for strong grasp. (Bottom) Typical wrist and digital posture necessary for strong grasp. The wrist is held in extension which allows the appropriate moment arm for the strong extrinsic digital flexors to pull across the MP and IP joints.

## CASE EXAMPLES

Patient 1: 60 year-old male who incurred a dominant right-sided humerus fracture and posterior shoulder dislocation after a fall from a ladder. Electrical studies showed a recovering brachial plexopathy mostly affecting the posterior cord. PIN release was performed at 3 months post-injury. Six months postoperatively, the patient continued to have poor grip and was noticed to have the above noted exam findings.

Patient 2: 62 year-old male who sustained a non-dominant, right-sided extended upper trunk plexopathy. At five months post-injury, a double fascicular to musculocutaneous and medial triceps to axillary nerve transfers were performed. Six months postoperatively, the patient continued to complain of difficulty grasping and had the noted exam findings.

## Table 1: Pre and Postoperative Results

	Patient 1		Patient 2	
	Preoperative	Postoperative	Preoperative	Postoperative
Grip (lb)	2	40	5	30
Key Pinch (lb)	7	21	10	13
DASH	74	32	73	72
Contralateral Grip		100		80
Contralateral Pinch		20		19

## CONCLUSIONS

Subtle exam findings must be noted early, especially in Sunderland III and mixed-type peripheral nerve injuries, with the aid of experienced hand therapists to make impactful surgical interventions and correct maladaptive substitutions. We have demonstrated improved functional grasp in two such cases where wrist extension was augmented with PT to ECRB tendon transfer.